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REPORT NO. 4-8-50G-1

MONTHLY PROGRESS REPORT

ENGINEERING PROGRAM FOR THE
DEVELOPMENT OF A LIGHTWEIGHT
ANTI-TANK ROCKET

FOR THE PERIOD

MONTH OF APRIL 1958

CONTRACT NO. RD-142

~~ORDNANCE PROJECT NO.~~

~~DEPT. OF ARMY PROJECT NO.~~

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HESSE - EASTERN DIVISION

FLIGHTEX FABRICS, INC.

PROGRESS REPORT #8

ENGINEERING PROGRAM FOR THE DEVELOPMENT OF A LIGHTWEIGHT ANTI-TANK ROCKET

APRIL 1958

CONTRACT NO. RD-142

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SUBMITTED BY: HESSE-EASTERN DIVISION
FLIGHTEX FABRICS, INC.
CAMBRIDGE, MASSACHUSETTS

WORK DONE DURING THE MONTH OF APRIL 1958

REPORTING PERIOD 5 APRIL TO 7 MAY 1958

SYSTEM EVALUATION PROGRAM

The remaining problems mentioned in last month's report received detailed attention during the month. Additional static penetration tests have been conducted, and pending one more test, the warhead can be chosen. The pressure of work connected with the motor development and the warhead development program have not permitted concentrated effort on the problem of the fuze graze sensitivity. However, a new concept of preventing bouncing and increasing the graze sensitivity of the fuze has been evolved. The problem of ignition has received detailed attention, and static tests have been conducted and checked out with dynamic ignition tests.

A program for completing the project has been drawn up and is shown in the appendix.

MOTOR DEVELOPMENT PROGRAM

INTRODUCTION

Further tests and engineering work was performed to find the cause and eliminate the difficulties so far experienced in obtaining proper ignition at both temperature extremes. Static tests were performed on different designs of igniters. The results of these tests were used as a basis of continuing the dynamic test program.

Inspite of the fact that the solution of the ignition problems appears to be close at hand, ignition problems were experienced. A very close group of five rounds fired at the high temperature was obtained. (Photograph No. 83)

Static tests were conducted to obtain time-pressure curves. A hydrostatic test fixture was designed, manufactured and used to find the yield and ultimate strength of the E. M. No. 2 motor. The results have been evaluated and will be used in specifying the characteristics of the final motor.

An engineering study is being conducted to re-check internal ballistics. The results of this will be used in finalizing the motor.

Velocities so far attained in the hot rounds seem to indicate that the propellant charge may be slightly reduced or the round weight increased. The design calls for a velocity of approximately 350 feet per second at 120° F. Velocities, however, have been in the neighborhood of 400 f/s.

Eighteen rockets were fired dynamically, and the results have been evaluated. Further tests are being prepared, and it is expected that the final order for motors will be placed early in June.

Prices have been obtained for the manufacture of 500 final motors based on preliminary drawings.

DESCRIPTION OF WORK

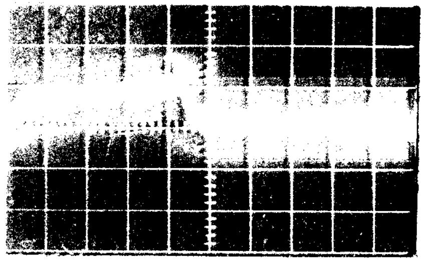
1. Static tests (time-pressure curve).

Photograph Nos. 71 through 80 show the time-pressure curves obtained. With the exception of Round Nos. 11 and 12 (Photograph Nos. 79 and 80), the curves were obtained from the propellant at ambient temperatures.

(Photograph Nos. 71 through 80 are shown on following pages.)

SECRET

Round #1



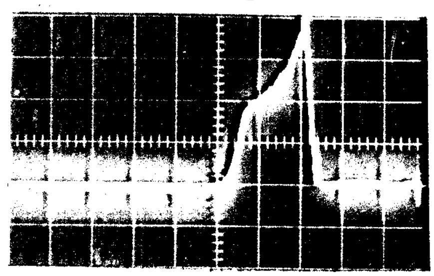
Photograph No. 71

Horizontal Calibration 5 ms/cm

Vetical Calibration .5 volts/cm

Peak Pressure 3,910 P.S.I.

Round #2



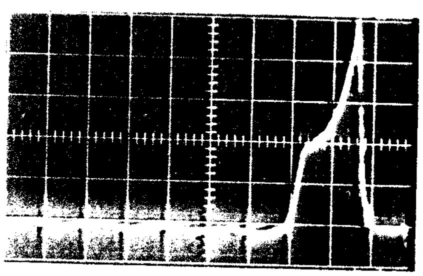
Photograph No. 72

Horizontal Calibration 10 ms/cm

Vertical Calibration .2 volts/cm

Peak Pressure 6,590 P.S.I.

Round #5



Photograph No. 73

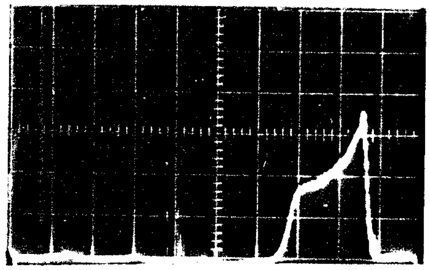
Horizontal Calibration 10 ms/cm

Vertical Calibration .2 volts/cm

Peak Pressure 7,980 P.S.I.

SECRET

Round #6



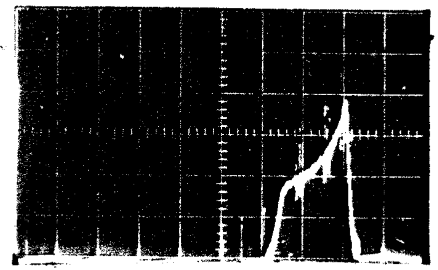
Photograph No. 74

Horizontal Calibration 10 ms/cm

Vertical Calibration .2 volts/cm

Peak Pressure 5,480 P.S.I.

Round #7



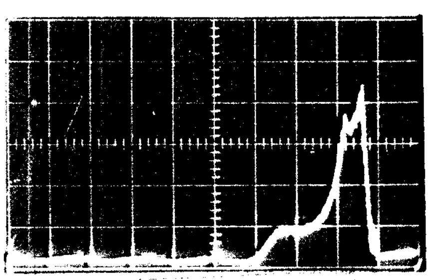
Photograph No. 75

Horizontal Calibration 10 ms/cm

Vertical Calibration .2 volts/cm

Peak Pressure 5,940 P.S.I.

Round #8



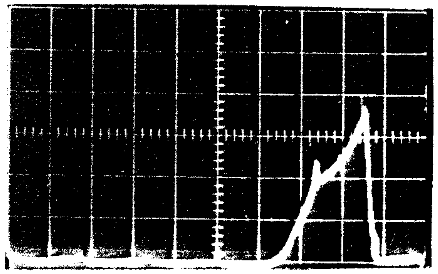
Photograph No. 76

Horizontal Calibration 10 ms/cm

Vertical Calibration .2 volts/cm

Peak Pressure 6,560 P.S.I.

Round #9



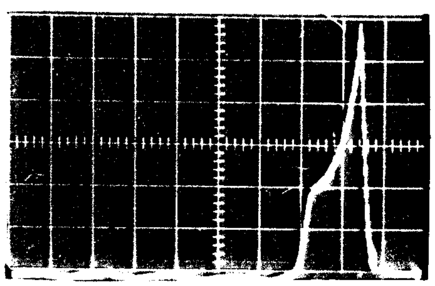
Horizontal Calibration 10 ms/cm

Vertical Calibration .2 volts/cm

Peak Pressure 5,640 P.S.I.

Photograph No. 77

Round #10



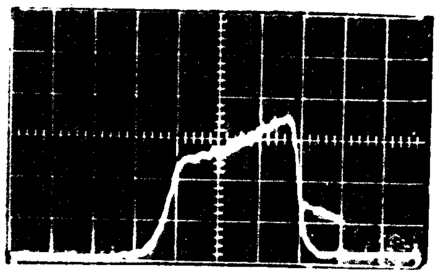
Horizontal Calibration 10 ms/cm

Vertical Calibration .2 volts/cm

Peak Pressure 9,090 P.S.I.

Photograph No. 78

Round #11 +120° F



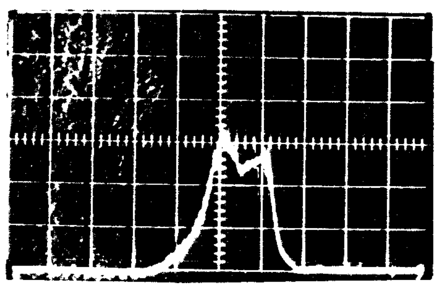
Horizontal Calibration 5 ms/cm

Vertical Calibration .2 volts/cm

Peak Pressure [illegible] P.S.I.

Photograph No. 79

Round #12 - 20° F



Horizontal Calibration 5 ms/cm

Vertical Calibration .2 volts/cm

Peak Pressure 5000 P.S.I.

Photograph No. 80

The curves indicate that the pressure and time duration is roughly in conformity with the original design. Some irregular peaks, however, can be observed which indicate that the propellant was probably shattered because of the excessive blowout pressure needed by the igniter. These peaks build up to pressures considerably over the design pressure in some case (See Round Nos. 2, 5 and 10). This is of importance in evaluating the motor failures, and the results of the hydrostatic tests. Further curves will be obtained, and the program of static motor tests will be continued until reliable and repetitive operation is obtained.

It is also of interest to note the burning time of the charges as shown in the traces. It appears that the propellant burns in approximately .020 seconds. It follows that longer burning times, if encountered, may be the result of improper ignition. Due to the fact that the T-1 test motor was used on T-2 and that a charge detonated, it will be necessary to repair the test motor. This will cause some delay before static tests can be continued.

DYNAMIC TESTS

The following tabulation shows the results of the dynamic tests conducted during the month. Round Nos. 134, 135 and 136 were fired early in the month. The remaining rounds were fired on the 29th using re-worked igniters.

FLIGHT TESTS APRIL 1958

Round No.	Temp.	Weight	Ignition	Velocity Ft/Sec.	Elevation Mills 70	Remarks
134	Amb.	1500				Motor failure
135	-20	1491				Motor failure
136	-20	1489				Motor failure
137	-30	1502	Incom.	200	80	Fractioned incompletely burned sticks
138	-30	1514	Apparently Complete	No Rec.	80	Over target
139	-30	1499	Incom.			Same as No. 137
140	-30	1507	Incom.	200	80	Two cracked sticks. Broken up prop left in launcher
141	-30	1500	"	250	80	"
142	-30	1543	"	200	80	"
143	-30	1484	"	210	80	"
144	+130	1438				Dud primer
145	+130	1480	OK	400	80	Burns 6" outside launcher
146	+130	1502	OK		70	High left burns as 145
147	+130	1534	OK	375	70	Center burns as 145
148	+130	1477	OK	400	70	" " " "
149	+130	1485	OK	395	70	" " " "
150	+130	1545	OK	370	70	Low center burns as 145
151	+130	1520	OK	365	70	Center burns as 145. No out-of-launcher burning.

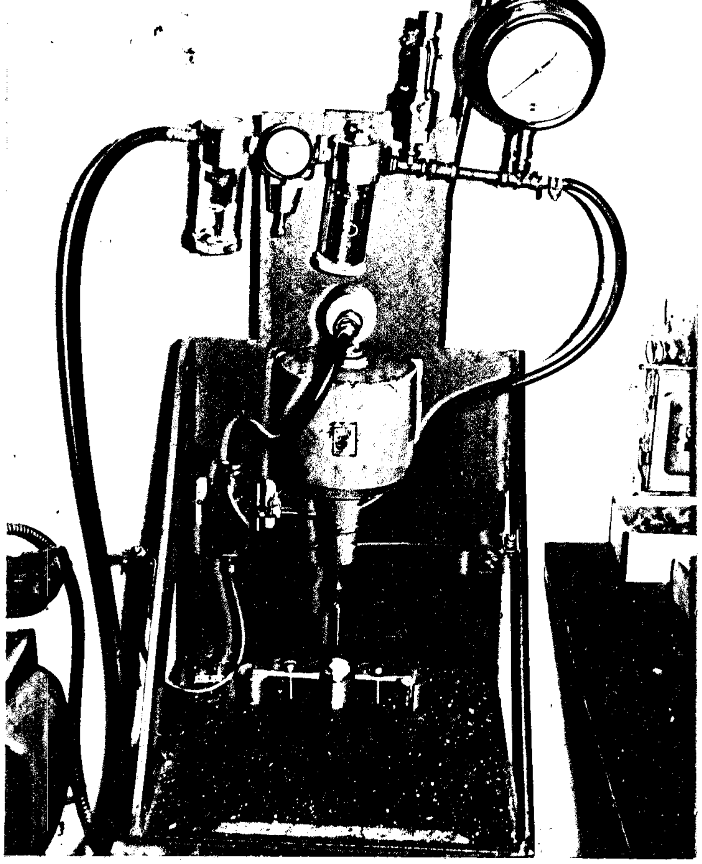
EVALUATION OF RESULTS (Round Nos. 134-136)

Upon examination of the broken motor bodies, it was decided that the pressure level required to blow out the igniter had been too high, and an intensive program of determining the proper blow-out pressure and setting up a test procedure was put into effect.

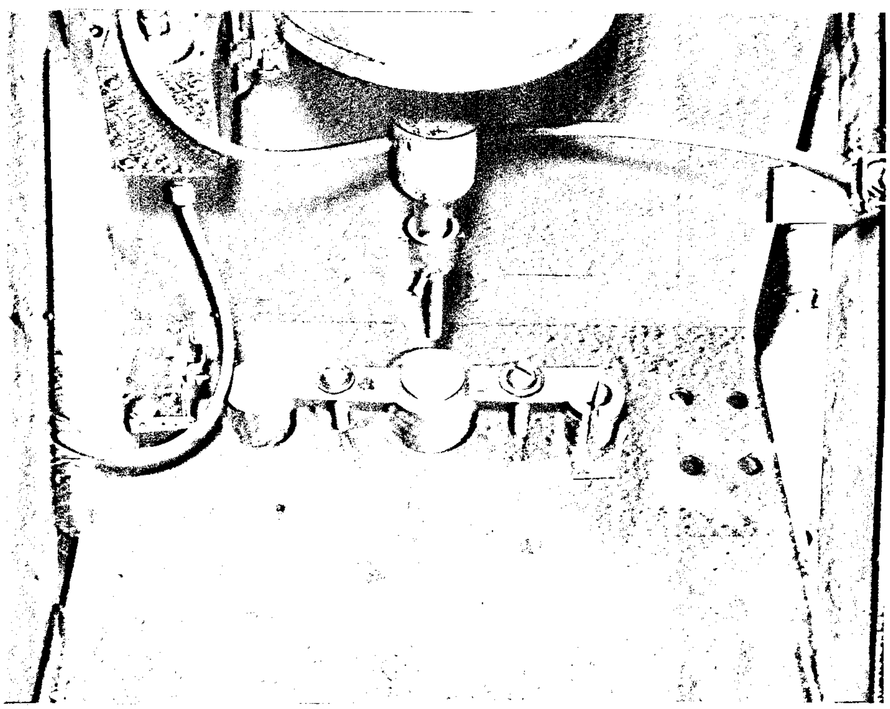
It appeared that changes in igniter configuration were responsible for an increase in blow-out pressure. The addition of the aluminum powder in some rounds fired the previous month could not be held responsible.

A fixture was manufactured (See Photograph Nos. 81 and 82), and tests were conducted to determine the difference of blow-out pressure required with the light versus the heavy wall.

(Static Comparison Test is shown on the following pages.)



Photograph No. 81



Photograph No. 82

STATIC COMPARISON TEST

SUBJECT: Thin Wall and Heavy Wall Igniters.

DETERMINE: Force required to blow the igniter through the throat of the motor body.

EQUIPMENT USED: Air cylinder with an 18 to 1 ratio.

THIN WALL (.080) TYPE

No.	Input (Air Press.)	Output (Lbs.)	Results
1	11	198	Did not budge
b.	11 1/2	207	" " "
c.	12	216	" " "
d.	12 1/2	225	" " "
e.	13	234	" " "
f.	13 1/2	243	Igniter forced its way through the nozzle very slowly
2	14	252	Passed through slowly
3	14	252	" " "
4	14	252	" " "
5	14	252	" " "
	HEAVY WALL TYPE (.115) WITH THE NEW LOCKING LIP		
6	13 1/2	243	Did not budge
b.	14	252	" " "
c.	14 1/2	261	" " "

(Continued)

No.	Input (Air Press.)	Output (Lbs.)	Results
d.	15	270	Did not budge
e.	15 1/2	279	" " "
f.	16	288	Igniter forced its way through the nozzle very slowly
7	16 1/2	297	Passed through the throat much slower than Nos. 2, 3, 4, 5
8	17	306	Same as No. 7
9	17	306	" " " "
10	17 1/2	315	Same as Nos. 2, 3, 4, 5. (We now have a good comparison of force required to blow out the thin and heavy wall igniters.)
	DESIGN WITH NEW INSIDE CONFIGURATION OF THE "BLACK POWDER" CAVITY AND A 3/16 RADIUS WHERE THE PRESENT .750 R. MEETS THE O. D. OF THE IGNITER		
11	12	216	Did not budge
b.	13 1/2	243	" " "
c.	14	252	Passed through nicely. Wall that enclosed the black powder deformed evenly all around.
12	14	252	Passed through extremely slow. 3/16 radius mentioned above was omitted.
13	14	252	Passed through very slow (3/16 radius is required on the basis of Round Nos. 12 and 13.)
14	14	252	Passed through at about the same rate as Round Nos. 2,3,4,5
15	14	252	Same as No. 14.

The result of these tests may be summed up as follows:

The heavy wall type of igniter required a pressure of nearly 300 lbs. to be forced through the throat. This is more than 50 lbs. in excess of the requirements of the (old) thin walled design.

It must be borne in mind that the locking lip and its effect on the blow-out pressure under dynamic conditions could not be determined in this way. In addition, it has to be pointed out that the amount of black powder used (5 grams) may prove to be excessive since the locking lip makes a tighter closure, and it is now impossible for the gases to escape around the outside of the stem of the igniter. This, however, could only be determined by dynamic tests.

EVALUATION OF ROUND NOS. 137-151

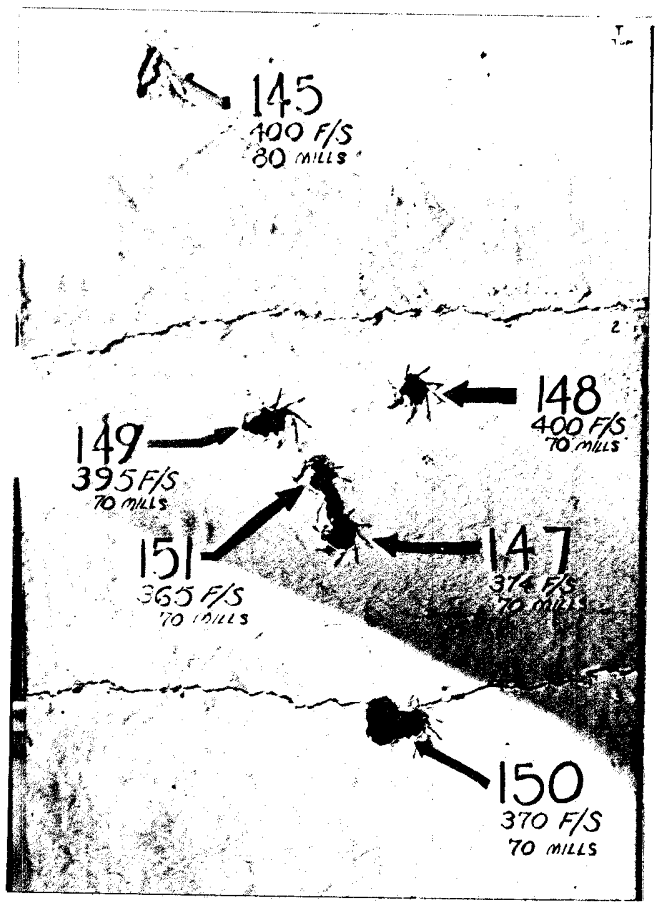
The results of this test may be summed up as follows:

1. A good group was obtained on the target with the hot rounds (See Photograph No. 83 on following page).

2. The round is stable even at velocities as low as 250 f/s.

3. Round No. 144 shows that a change in primers may be indicated, possibly using commercial primers obtained from stripping standard ammunition. The primer in this round showed a deep indentation from the firing pin, and the firing mechanism showed every indication of having worked properly.

4. All cold rounds had improper ignition with two cracked sticks still attached to the plate and with propellant particles left in the launcher. Round No. 138 is an exception to this. This round burned



Photograph No. 03

its propellant completely and went over the target.

CONCLUSIONS

Based on the evidence of this test, it appears that the following areas of the round design will have to receive attention:

1. The internal ballistics.

The velocities of the hot roundswere too high which may result in out of launcher burning at low temperature when good ignition is obtained. The problems in obtaining ignition justify a re-check of the internal ballistics.

This work has been partly completed, and the calculations in the appendix show that the internal ballistics are sound. However, a reduction of the over-all diameter of the sticks may be desirable. In addition, it may be desirable to decrease the length of the sticks in order to decrease the velocity of the round and to bring the end of the sticks further away from the black powder charge.

2. The igniter.

As mentioned previously, we may now be faced with the fact that the black powder charge is excessive. The evidence of cracked and incompletely burned sticks tends to confirm this idea. It is probable that the following took place in the motors of the cold rounds: the excessive amount of black powder produced a shock wave which shattered part of the propellant. All the propellant ignited, but due to the fact that some of it was in small fragments, this (the shattered pieces) was lost through the nozzle when set back occurred.

A test is in process of being prepared where a number of different approaches to this problem will be tested.

HYDROSTATIC TESTS

The motors of E. M. No. 2 were tested for ultimate and yield strength. It was found that bulging occurred at 7,000 psi and failure at 7,500. This does not leave a satisfactory safety factor, and the wall thickness and the alloy will have to be changed to eliminate this problem. However, tests with Model 2 will continue. As shown by the time-pressure curve, pressures of more than 7,000 psi are unlikely to be encountered if no sharp peaks in the pressure due to an increase of burning surface are caused by fractured propellant.

PROGRAM FOR FUTURE ACTION

The program in the appendix shows the motor program in detail. It appears that the time schedule can be adhered to provided that the solution of the ignition problems does not take an excessive amount of time.

WARHEAD DEVELOPMENT PROGRAM

The static penetration tests mentioned on page 9 of last month's progress report have been conducted, and the results are listed on the following pages.

Hesse-Eastern

PENETRATION TEST

DOUBLE ANGLE LINERS

1 1/2" DIA. BOOSTER 3" STAND-OFF

11 APRIL 1958

Round No.	Charge Wgt. Grams	Volume C.C.	Density Grams/C. C.	Penetration (Mild Steel)
1	444.2	257.8	1.71	9"
2	427.6	242.8	1.76	12"
3	434.6	242.4	1.79	7"
4	450.0	243.8	1.85	11 1/2"
5	441.7	241.4	1.83	9 1/2"

3/4" DIA. BOOSTER 3" STAND-OFF

6	443.5	260.3	1.69	8 1/2"
7	450.8	257.0	1.76	13 1/2"
8	458.6	261.7	1.74	14"
9	452.1	255.5	1.77	9 1/2"
10	454.6	257.4	1.76	9"

PENETRATION TEST

DOUBLE ANGLE LINERS

3/4" DIA. BOOSTER 3 3/8" STAND-OFF

22 APRIL 1958

Round No.	Charge Weight	Volume	Density g/cc	Penetration Mild Steel	Remarks
11	461.5	271.2	1.7	8	
12	462.5	269.0	1.71	8	2 top plates cracked
13	460.0	268.6	1.71	8 1/2	Top plate cracked
14	454.9	273.8	1.67	11 1/4	
15	458.5	259.8	1.765	11 1/4	

PENETRATION TEST

SINGLE ANGLE LINERS

3/4" DIA. BOOSTER

22 APRIL 1958

Round No.	Charge Wgt.	Volume	Density g/cc	Penetration Mild Steel	Stand-Off	Remarks
1	428.7	248.0	1.72	5	4 1/2	Top Plate Split in 2
2	429.7	253.3	1.68	7 1/2	4 1/2	Note 1

(Continued)

Round No.	Charge Wgt.	Volume	Density g/cc	Penetration Mild Steel	Stand-Off	Remarks
3	430.9	256.2	1.68	8	4 1/2	Note 2
4	430.8	258.4	1.67	5	4 1/2	Note 3
5	434.3	259.2	1.675	7	4 1/2	Note 4
6	441.9	258.3	1.7	1	5 1/2	Note 5
7	440.5	256.8	1.7	5	5 1/2	Note 6
8	436.9	255.6	1.7	5	5 1/2	
9	438.0	240.9	1.82	9 1/2	5 1/2	
10	440.4	257.8	1.71	9 1/2	5 1/2	

NOTES:

1. Top plate hole 3" lg X 1" wide. Second plate 2" X 1 1/4" and split third plate 1 1/4" X 1/4".

2. Top plate hole 3" lg X 1 1/2 wide on top on bottom 1 1/4" lg X 1/2" wide.

3. Top plate hole 4" lg X 1 1/2" wide on top on bottom 1 1/2" lg X 1/2" wide.

4. Top plate hole 3 1/4" lg X 1" wide on top on bottom 2 3/4" lg X 1/2" wide.

5. Bottom of cone and head very eccentric at bottom. At penetration the hole sheared off to an angle almost splitting block in two. Did not penetration second block.

6. Top plate split in two, pieces flew through air. One landed in front of operations building door and partly buried. Other flew in opposite direction at least 50' distant.

The best average penetration was obtained with a 3" stand-off and a 3/4" booster. However, the results obtained from the single angle liners are poor due to excessive out of round condition of the steel head bodies. The averages are as follows:

Group 1 (3" stand-off and 1 1/2 booster) 9.8" with a maximum variation of 4 1/2".

Group 2 (3" stand-off and 3/4 booster) 10 1/2" with a maximum variation of 5".

Group 3 (3 3/8" stand-off and 3/4 booster) 9.4" with a maximum variation of 3 1/4".

Group 4 (single angle with 4 1/2" stand-off) 6.5" maximum variation 3".

Group 5 (single angle with 5 1/2" stand-off) 5.8" maximum variation 4 1/2".

The notations regarding the shape of the holes obtained with the single angle liners indicate that the out of round condition of the heads has a very marked effect on single angle liners. Round No. 6 was not included in computing the average penetration of Group 5. Its head body was .015 T.I.R. out of round.

In order to obtain some comparison with the efficiency of the M31 grenade head, ten M31 heads were statically tested using the fuze of the grenade and standing it off the plate a distance which would correspond to the actual condition when a head is dynamically fired and when the "lucky" element touches the plate. The heads had complete ogives except for the end caps. They were positioned vertically to the plate. The lot of plates used for the tests with our heads were also used for this test. The results were as follows:

M-31 PENETRATION TESTS

Conditions: 15 mild steel plates 6" X 6" X 1"
Hardness reading B-58 to 61
Stand-off distance = 1/2" from nose of insulator

(Live T-1022E2 Fuze with tetryl booster)

Round No.	Penetration
1	11 1/8
2	10 1/8
3	11 7/8
4	10 1/4
5	11 3/4
6	11 1/4
7	8 1/4
8	12 1/4
9	9
10	12

Average 10.79

It is to be noted that the maximum variation is 3 1/4" which does not compare too unfavorably with our head when one takes into consideration that we are dealing with a fully developed head which is a production item and therefore has excellent concentricities in its metal parts.

It is expected that the results will show less variation if drawn metal parts are used.

In view of the poor results obtained from the single angles liners, it was decided to run one more static penetration test with the remaining metal parts. This test will be conducted as follows:

Ten heads will be loaded by Mr. Cox and contain double angle liners and 3/4" boosters. They will be fired at 3" stand-off.

Ten heads will be assembled with single angle liners and fired with 4 1/2" stand-off. They will be loaded by us.

Five heads will be loaded by us and used for detonator safety tests. The head bodies of those five are too far out of round as to be used for anything else. The result of these tests will put us in a position to order the final lot of components. It is expected that this work will be completed early in June.

A new and more accurate method was used to determine the density of the charge. Until this time, the volume of only one head body had been measured, and the figure thus obtained was used for all remaining bodies. This procedure may lead to inaccurate results. The volume of each head was therefore determined individually. Great care was taken in taking all weight and volumetric measurements. The results compare favorably with information obtained from Mr. Cavennaugh of Picatinny Arsenal. It is probably safe to assume that the low density reported in some of the previous heads was due more to the method used to determine density than to any actual lack of density. We carefully checked our methods of loading with Picatinny Arsenal and found them to be assentially identical to their methods.

FUZE DEVELOPMENT PROGRAM

Due to the intensive effort which was put behind the motor program, very little could be done on the fuze program. However, the fifty sets of components which were ordered for fuze testing have been completed. In addition, a new concept of eliminating bounce and improving graze sensitivity is being worked on.

This approach will incorporate a simple lock which will prevent the triggering sleeve from coming off until the rotor has partly or completely turned into the armed position. An engineering layout has been started, and it is expected that components for testing will be available in June.

LAUNCHER DEVELOPMENT PROGRAM

The part of this program which deals with the igniter has been discussed in the motor section. A new design of the cross piece is presently being worked on. This will eliminate the present difficulties in assembling the cross piece and the fact that the hole in the cross piece has to line up accurately with the bore of the igniter.

The new construction will have a cross piece which reaches around the body of the igniter. The cross hole for the obstructing pin will be positioned by means of a snap ring on the igniter body and a key and slot in cross piece and igniter. This arrangement will be fully illustrated in next month's report.

Several methods for locking the handle in the vertical position have been tried but so far none have been positive and simple enough to be adopted.

The steel prototype launcher was used in all dynamic firings, and with the exception of the one primer malfunction, no trouble was experienced. One complete weapon system will be given to Bob when he next visits here. This will contain the actual launcher, a dummy head and fuze, the last design of the cross piece and E. M. No. 2 motor.

The materials and finishes specified in the various launcher components are receiving detailed attention from the point of view of corrosion, high and low temperature, dust, sand, etc. It is expected that the approach to the final test program will be discussed at our next meeting.

Thomas H. F—

Project Engineer

Evaluated vs. costs expended for the month

$9675.82 OK Charles B. Walker

General Manager

APPENDIX

Motor Internal Ballistics

Final Test Program

MOTOR INTERNAL BALLISTICS

1. $A_{SP} = 4\pi L (d_2 + d_1) + \dfrac{8\pi (d_2^2 - d_1^2)}{4}$

2. $A_{SP} = 4\pi\ 4.72 (.64) + 4\pi\ (.520)(4.47) + \dfrac{8\pi (.64^2 - .52^2)}{4}$

3. $A_{SP} = 12.58 (5.421) = 68 \text{ in}^2$

4. $A_t = \dfrac{\pi (.64)^2}{4} = \dfrac{\pi (.41)}{4} = .3225 \text{ in}^2$

5. $K_t = \dfrac{A_{SP}}{A_t} = \dfrac{68}{.3225} = 210.5$

6. $A_p = \dfrac{\pi D_1^2}{4} - \dfrac{4\pi}{4}(d_2^2 - d_1^2) = \dfrac{\pi}{4}(D_1^2 - N(d_2^2 - d_1^2))$

7. $A_p = 1.720$

8. $\dfrac{A_p}{A_t} = \dfrac{2.161}{.3225} = 6.71 \therefore 72$

9. $K_o = \dfrac{4 N d_2 L}{D^2 - N d_2^2}$

10. $K_o = 43.3$

11. $K_i = \dfrac{4 L_1}{d_1} = \dfrac{4 (4.67)}{.52}$

12. $K_i = 36$

13. $\frac{K_i}{K_o} = \frac{36}{43.3} = .832$

14. $\frac{K_o}{K_t} = \frac{43.6}{210} = .208$

15. $\frac{K_i}{K_t} = \frac{36}{210} = .171$

Conclusions

The above calculations show that the internal ballistics are sound rocket design. The K_i over K_o ratio should ideally be 1. In order to reduce burning distance and improve this factor, assume a reduction in O. D. of the propellant from .640" to .620".

16. $A_{SP} = 4\pi \left((.62)(4.72) + (.52)(4.47) + \frac{((.620^2) - (.52)^2)}{2} \right)$

17. $A_{SP} = 12.58\ (5.297) = 66.5$

18. $K_t = \frac{A_{SP}}{A_t} = \frac{66.5}{.3225} = 206$

19. $K_o = \frac{4\ N\ D_2\ L}{D^2 - N\ d_2^{\ 2}} = 38.4$

20. $\frac{K_i}{K_o} = \frac{36}{38.4} = .94$ Ratio obtained by reduction in O. D.

21. $\frac{K_o}{K_t} = \frac{38.4}{206} = .186$ 2.65

22. $\frac{K_i}{K_t} = \frac{36}{206} = .175$ 2.65

SECRET

SCHEDULE

DESCRIPTION — **MONTH & WEEK**

APR.	MAY					JUNE					JULY				AUGUST				SEPTEMBER				
21-25	28-2	5-9	12-16	19-23	26-30	2-6	9-13	16-20	23-27	30-4	7-11	14-18	21-25	28-1	4-8	11-15	18-22	25-29	2-5	8-12	15-19	22-26	29-3

I MOTOR & IGNITION

1. ESTABLISH TIME PRESSURE CURVE BY STATIC TESTS.
2. HYDROSTATIC MOTOR & ADAPTER TESTS. ESTABLISH PROCEDURE.
3. STATIC IGNITION TESTS ESTABLISH PROCEDURES.
4. DYNAMIC IGNITION TESTS.
5. PREPARE FINAL MOTOR DRAWINGS.
6. FINAL DRAWINGS OF IGNITER.
7. DESIGN TAIL FINS FOR FINAL MOTOR.
8. TEST NEW TAIL FIN.
9. FINAL TAIL FIN DRAWINGS
10. ORDER FINAL MOTORS (500)
11. ORDER FINAL IGNITERS (600)
12. ORDER FINAL TAILS
13. CHECK OUT TESTS WITH FINAL LOTS.
14. ESTABLISH ASSEMBLY PROCEDURES. TOOLING - CUPPING
15. FINAL TESTING

II HEAD

1. STATIC TESTS - DOUBLE ANGLE CONE AT 3 3/8 S.O.
2. SINGLE ANGLE CONE AT 4 1/2 - 5 1/2 S.O.
3. DESIGN CONE
4. 25 HEADS ASSEMBLED FOR RETEST AT EASTERN TOOL.
5. LOADED BY COX.
6. LOADED BY U.S.
7. TESTED
8. DETONATOR SAFETY TEST
9. FINAL HEAD DRAWING.
10. ORDER FINAL
11. CHECK OUT DYNAMIC PENETRATION.
12. FINAL TESTING

III FUZE

1. TEST (20) FOR FUNCTIONING SAFETY.
2. ENGINEERING & TEST TO OBTAIN GRAZE STATICLY.
3. MANUFACTURING OF (50) SETS OF COMPONENTS.
4. TEST (30) - GRAZE.
5. TEST (20) - ARMING.
6. DETONATOR SAFETY (SEE HEAD).
7. FINAL DRAWING.
8. WATERPROOFING.
9. DYNAMIC PENETRATION TEST (10)
10. FINAL DYNAMIC PENETRATION.
11. PLACE ORDER FOR FINAL LOT (600)
12. TEST FINAL LOT.
13. FINAL TESTING.

IV LAUNCHER

1. DESIGN SNAP LOCK.
2. REDESIG CROSS PIECE & CROSS PIN.
3. MANUFACTURE & TEST NEW DESIGN.
4. FINAL DRAWING'S.
5. ORDER FINAL QUANTITY (350
6. TEST FINAL DESIGN DYNAMICALLY (40)
7. ESTABLISH ASSEMBLY PROCEDURES & TOOLING.
8. PACKAGING

V ROUND EVALUATION

TESTING FINAL LOT FOR DYNAMIC PENETRATION GRAZE & ACCURACY.

VI SYSTEM EVALUATION

FINAL TESTING PROGRAM (SEE DRAWING # D-8340)

HESSE-EASTERN DIVISION OF FLIGHTEX FABRICS, INC.
~~CAMBRIDGE, MASS.~~ EVERETT, MASS.
PROGRAM

BY: [illegible] 4-29-5[illegible] | CH'K'D: T.F. | ENG'R | APP'D | D 8346 | REV. 0

PROJ. 506-J | SCALE | MAT'L | ASSY DWG | REF DWG

UNLESS OTHERWISE NOTED
CONCENTRIC WITHIN T.I.R.
ALL DIA. ON SAME ₵ TO BE
ANGULAR ±1°
FRACTIONAL ±1/64
DECIMAL ±.005
STANDARD TOLERANCES
BREAK ALL SHARP CORNERS .005-.010
EXCEPT WHERE NOTED
125 FINISH ALL OVER
AFTER PLATING
ALL DIMENSIONS APPLY
DO NOT SCALE DRAWING
REVISIONS

SECRET

SECRET

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